START

29
0013349

DUN-3155 74

# AN INVESTIGATION OF EFFLUENT CONTROL STANDARDS AND PRACTICES

BEST AVAILABLE COPY

[redacted]



SEPTEMBER 1967

MASTER

1417

## TABLE OF CONTENTS

UNCLASSIFIED

DOUGLAS UNITED NUCLEAR, INC.
RICHLAND, WASHINGTON

DOCUMENT NO.
DUN-3535

DATE 9/26/67
COPY NO.

CIRCULATING COPY
RECEIVED 700 AREA
JAN 26 1968
RETURN TO
DOUGLAS UNITED NUCLEAR, INC.
DOCUMENT CONTROL CENTER

AN INVESTIGATION OF EFFLUENT CONTROL STANDARDS AND PRACTICES

J. W. Loe, Engineer
Production Fuels Section

DISTRIBUTION

DUN

| | NAME | BUILDING | AREA |
|---|---|---|---|
| 1. | GO Amy | 313 | 300 |
| 2. | RC Bell | 313 | 300 |
| 3. | AE Brown | 305 | 300 |
| 4. | CD Corbit | 1760 | 100-H |
| 5. | JA Cowan | 3720 | 300 |
| 6. | RG Geier | 1760 | 100-D |
| 7. | WO Goslin | 3703 | 300 |
| 8. | FW Grubb | 3717 | 300 |
| 9. | LD Gustafson | 3703 | 300 |
| 10. | GB Hansen | 3720 | 300 |
| 11. | DC Harland | 313 | 300 |
| 12. | GA Huff | 3703 | 300 |
| 13. | RL Huff | 313 | 300 |
| 14. | F Hunter | 3703 | 300 |
| 15. | OB Isaacs | 313 | 300 |
| 16. | WR Kirk | 333 | 300 |
| 17. | HP Kraemer | Federal | 700 |
| 18. | JW Loe | 313 | 300 |
| 19. | JL Lorenzen | 3707D | 300 |
| 20. | WM Mathis | 3703 | 300 |
| 21. | HC Money | 3703 | 300 |
| 22. | JW Nickolaus | 333 | 300 |
| 23. | EV Padgett | 313 | 300 |
| 24. | PR Praetorius | 306 | 300 |
| 25. | RJ Pyzel | 313 | 300 |
| 26. | JE Ruffin | 303J | 300 |
| 27. | CH Shaw | 3707A | 300 |
| 28. | JS Shipp | 313 | 300 |
| 29. | JH Soehnlein | 1760 | 100-H |
| 30. | HL Sterling | 333 | 300 |
| 31. | JT Stringer | 3703 | 300 |
| 32. | FL Van Wyck | 313 | 300 |
| 33. | GW Wells | 1704 | 100-H |
| 34. | JC Williamson | 3706 | 300 |
| 35. | DUN File | 703 | 700 |
| 36. | DUN Record | 703 | 700 |
| 37.-46. | Extras | | |

AEC-RL

| | NAME | BUILDING | AREA |
|---|---|---|---|
| 47.-48. | W Devine | Federal | 700 |
| 49.-50. | CN Zangar | Federal | 700 |

ARHCO

| | NAME | BUILDING | AREA |
|---|---|---|---|
| 51. | GE Bachman | 222T | 200 |

B-NW

| | NAME | BUILDING | AREA |
|---|---|---|---|
| 52. | JP Corley | 3706 | 300 |
| 53. | RB Hall | 3706 | 300 |
| 54. | WC Horton | 329 | 300 |

AEHF

| | NAME | BUILDING | AREA |
|---|---|---|---|
| 55. | FE Adley | 747 | 700 |
| 56. | DE Anderson | 747 | 700 |

| ROUTE TO | PAYROLL NO. | LOCATION | FILES ROUTE DATE | SIGNATURE AND DATE |
|---|---|---|---|---|
| File Record | | | | |
| | | | | |
| | | | | |

OFFSITE DISTRIBUTION
Approved By

54-3100-184 (10-58)
AEC GPO RICHLAND, WASH.

UNCLASSIFIED
(CLASSIFICATION)

TO BE USED ON UNCLASSIFIED AND OFFICIAL USE ONLY DOCUMENTS.

## LIST OF TABLES



9212

# LIST OF ILLUSTRATIONS

# AN INVESTIGATION OF EFFLUENT CONTROL STANDARDS AND PRACTICES

## I. INTRODUCTION

In conjunction with the increased emphasis being placed on air and water effluent quality within Federal facilities, it became necessary to investigate the various aspects of effluent control responsibilities applicable to the Production Fuels Section. To add impetus to the study, a recent RL-AEC Waste Disposal Inspection Report of Douglas United Nuclear (Reference 5) recommended that nonradioactive chemical releases to 300 Area lagoons be analyzed to assure compliance with accepted release standards.

The task at hand was to assemble the various authoritative standards, investigate current practices, compare these practices with accepted standards, and establish a responsive effluent control program aimed at continuing compliance with these standards.

Effluent control practices were compared with the following release criteria supplied by the Federal and State Governments:

- Executive Order 11288, "Prevention, Control, and Abatement of Water Pollution by Federal Activities," dated July 7, 1966
- Proposed Washington State Quality Standards for Interstate and Coastal Waters," dated June 6, 1967
- Executive Order 11282, "Prevention, Control, and Abatement of Air Pollution by Federal Activities," dated May 26, 1966
- Tentative Hanford Air Quality Guide (to be issued)
- RL Manual Appendix 0510, Part I, "Radioactive Waste Disposal Guides," dated July 13, 1967

Copies of these standards can be found in the Appendices of this report.

It is trusted that the information contained herein will serve the dual purpose of providing the necessary inputs to those immediately responsible for pollution control and informing others of the current effort being made to assure continuing compliance.

## II. SUMMARY

### A. LIQUID EFFLUENT CONTROL

This investigation showed that the chemical and sanitary effluents being released by the 300 Area contractors to the process ponds and septic tanks do not contribute a significant amount of pollution to the environs. This conclusion is based on the results of a comprehensive sampling survey of the north process pond, Columbia River bank seepage, leaching trenches, and the Columbia River.

Current storage facilities for liquid chemicals as presently located would not contribute a significant amount of water pollution in the Columbia River should a rupture or accidental drainage occur.

Operating procedures are available involving the receiving, storing, and distributing of liquid chemicals and their subsequent use in the production process. These procedures provide a comprehensive summary of the methods utilized in controlling the various production process variables.

Future action planned in order to assure continuing compliance includes the gathering of effluent samples by an automatic effluent sampler at the process pond inlet. Chemical and radiochemical analyses will be periodically performed. Grab samples will be taken from the wells in the vicinity of the ponds, along with Columbia River bank seepage samples, to assess the amount of contaminants in the ground water. Samples from the leaching trenches and Columbia River will continue to be taken and analyzed for Biochemical Oxygen Demand (BOD) and coliform content by Battelle-Northwest.

### B. GASEOUS EFFLUENT CONTROL

The results of a survey of the Production Fuels Section powerhouse stack by HEHF were inconclusive because of the difficulty in obtaining a representative sample. Additional studies are scheduled to be initiated during the winter months when high steam generation rates are expected.

Smoke density measurements indicate compliance with the standards. The recommendation from HEHF regarding the type of smoke alarms for monitoring the combustion units is pending until a reply to an inquiry to the Department of Health, Education, and Welfare is received by the AEC.

The disposal of refuse that can be burned in open pits does not comply with the 25-pound-per-day limit. Because of the remote location, low population density, and favorable meteorological conditions, it is believed that the standard is unduly restrictive; and an exemption has been requested by the AEC. Special disposal precautions will be used should significant quantities of dark-smoke-producing refuse be accumulated.

HEHF is scheduled to procure air monitoring equipment in October, 1967, and will monitor selected locations in the 300 Area to determine if the Production Fuels Section's gaseous effluents are harmful. Until that time, no change in the current mode of operation is contemplated.

## III. AUTHORITATIVE STANDARDS

### A. LIQUID EFFLUENTS (NONRADIOACTIVE)

Executive Order 11288, dated July 7, 1966, outlines the necessary Federal government policy and requirements that are applicable to Federal agencies and the Atomic Energy Commission and its contractors in regard to the prevention, control, and abatement of water pollution. Detailed copies of this correspondence are included in Appendix I.

In addition to Executive Order 11288, the Production Fuels Section is expected to comply with the water quality standards as established by the state of Washington. Hearings were held in Olympia on June 6, 1967, regarding a proposal before the Pollution Control Commission for the adoption of water quality standards for interstate and coastal waters of the state of Washington, and a plan for implementation and enforcement of such standards.

In the proposed standards, the Columbia River has been categorized in Class A from the mouth to Grand Coulee Dam. Water quality criteria applicable to this classification are listed in Appendix II.

### B. GASEOUS EFFLUENTS (NONRADIOACTIVE)

Executive Order 11282, dated May 26, 1966, outlines the necessary Federal government policy and requirements that are applicable to Federal agencies and the Atomic Energy Commission and its contractors in regard to the prevention, control, and abatement of air pollution. Detailed copies of this correspondence are included in Appendix V.

As an initial attempt to satisfy the intent of Executive Order 11282, tentative Air Quality Guides for the Hanford Plant have been established (Appendix VI). These limits, generated by representatives of the Hanford contractors and the Richland Operations Office of the AEC, would apply at the boundaries of the reservation and are based on 1/10 of the Occupational Threshold Limit Values (See Appendix VII). The Threshold Limit Values refer to air-borne concentrations of substances and represent conditions under which it is believed that nearly all workers may be repeatedly exposed, day after day, without adverse effect. Selected monitoring of the air within the plant boundaries will be the responsibility of HEHF. After locating the source of the pollutant, it is expected that specific building and process effluent release standards will be developed in the future to reduce the concentration of those pollutants which exceed the standards.

In addition to Executive Order 11282, the AEC in a letter dated April 21, 1967, directed that no rubber, tar, petroleum or other dark-smoke-producing materials be burned in open pits.

C. RADIOACTIVE RELEASE CRITERIA AND PROCEDURES

The release and control of solid, liquid, and gaseous, radioactive wastes is described in Sections D, E, and F of RL Appendix 0510 and will not be covered in detail in this document. Certain limits involving liquid and gaseous releases, however, were extracted and are listed below.

1. Liquid Radioactive Wastes (Open Pond Disposal)

"Liquid wastes discharged to large, open ponds should be essentially free of radioactive materials. Concentrations of $5 \times 10^{-5}$ µci/ml (low level) should not be routinely exceeded. In the event this concentration is exceeded, control should be established to evaluate the likelihood of its becoming an environmental contamination problem. Liquid wastes failing to meet this criteria should be transported to the 200 Area underground disposal facilities."

2. Gaseous Radioactive Wastes

"The guides for effluent release from each stack in the 300 Area are:

| Radionuclides | Release Guide (curie/week) 150-foot Stack | Short Stack or Vent |
|---|---|---|
| $Sr^{90}$ | $5 \times 10^{-2}$ | $1 \times 10^{-2}$ |
| $I^{131}$ | $2 \times 10^{-1}$ | $2 \times 10^{-1}$ |
| Pu (total) | $5 \times 10^{-3}$ | $1 \times 10^{-3}$ |
| U (natural) | $2 \times 10^{-2}$ | $4 \times 10^{-3}$ |
| Total of others except $H_3$, $C_{14}$, and Noble gases | 10 | 2 |

## IV. EFFLUENT SOURCE IDENTIFICATION

### A. LIQUID EFFLUENTS

#### 1. Chemical Storage

Outside storage tanks that supply the necessary process chemicals for the Production Fuels Section are listed along with the inventory value in Table I. Methanol, trichlorethylene, nitric acid, and sodium hydroxide are distributed by various pumping mechanisms through the 303-F Building. A schematic diagram of the location of the tanks and transfer lines is shown in Figure 1. For safety purposes, the methanol tanks are buried. Batch quantities of nitrated-caustic, deoxidizer, and Altrex are pumped after mixing in 303-F.

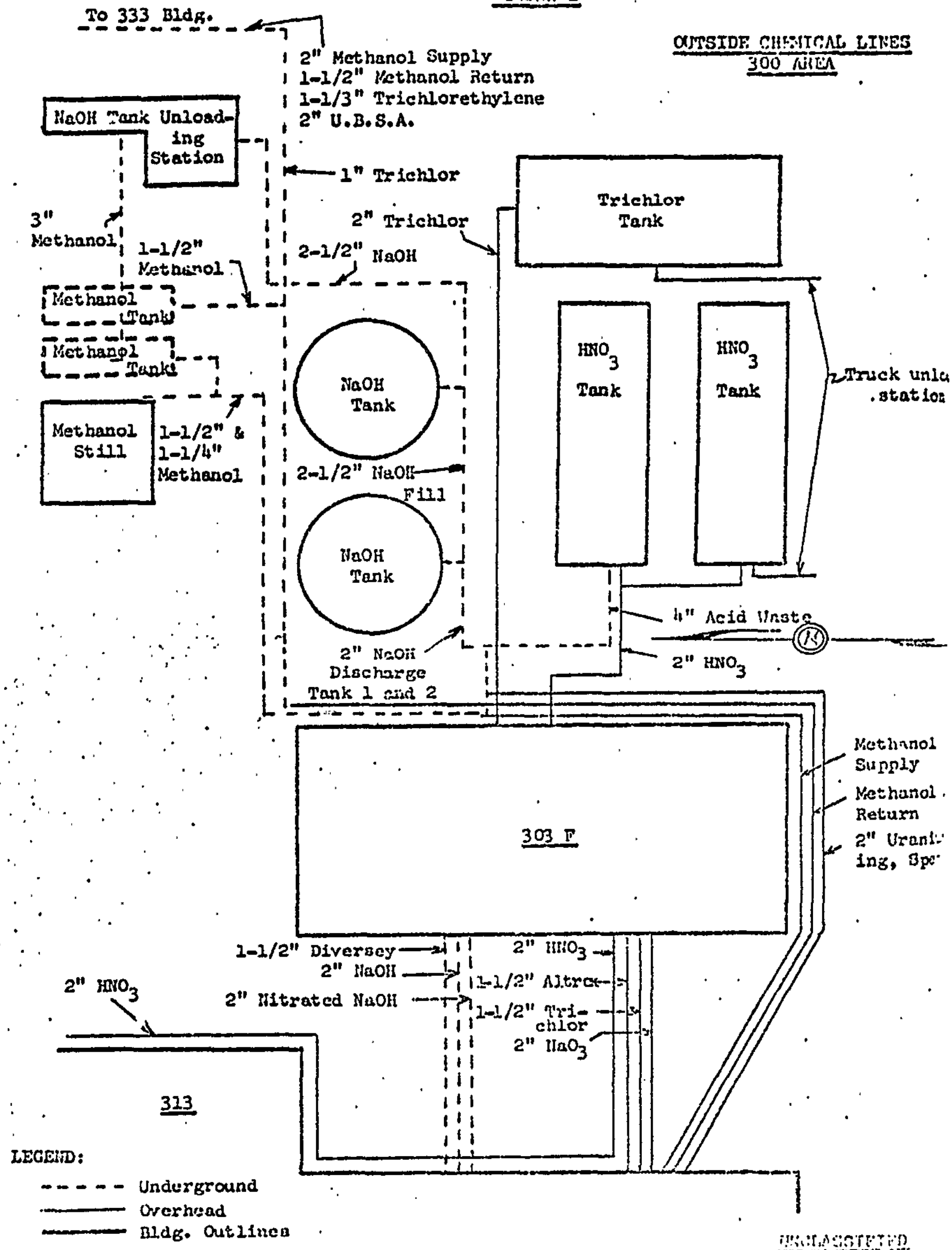
TABLE I

Fuel and Chemical Storage

| Chemical | Storage Capacity | Inventory Value |
|---|---|---|
| $HNO_3$ | 2 - 4,000 gal. tanks | $ 1,600 |
| NaOH | 2 - 10,000 gal. tanks | 4,000 |
| Trichlorethylene | 1 - 10,000 gal. tank | 10,900 |
| Methanol | 1 - 6,000 gal. tank<br>1 - 4,000 gal. tank | 3,000 |
| Fuel Oil | 2 - 75,000 gal. tanks<br>1 - 15,000 gal. tank | 10,500<br>1,050 |

FIGURE 1

OUTSIDE CHEMICAL LINES
300 AREA



2. Process Solutions

Table II lists the chemicals that are routinely discharged in significant quantities from the 313 and 306 buildings. A portion, if not all, of these eventually reach the Columbia River through underground seepage from the process ponds. The drainage of these chemicals flows through process sewer lines to the ponds as shown in Figure 2, with alternate use of the north and south ponds being made. The empty pond is scarified before being reused. Approximately 5.5 million gallons of effluent water is discharged daily from the total 300-Area operation which includes DUN and Battelle contributions. Pond operation and maintenance is the landlord responsibility of DUN.

TABLE II

Liquid Effluents Routinely Discharged to the Process Sewer

313 Building - Component Preparation

| Location | Chemical | Quantity (gal) | Concentration (lbs/gal) | Dumping Frequency |
|---|---|---|---|---|
| Sleeve Machine | NaOH | 800 | 2.2 - 3.3 | 2 Weeks |
| Sleeve Machine | Ivory Soap | 50 | 0.1 | Twice Daily |
| Sleeve Machine | $NaAlO_2$ | 100 | 0.03 - 0.07 | Daily |
| Cap & Can Machine | Cleaner | 1080 | 0.19 - 0.34 | 36 Line-days |
| Cap & Can Machine | Deoxidizer[2] | 710 | 1.25 - 2.5 | 72 Line-days |
| Spire Etch | (NaOH | 300 | 0.26 - 0.55 | Twice Weekly |
| | ($NaNO_3$ | 300 | 0.20 - 0.60 | Twice Weekly |
| | (Chelating Agent[3] | 300 | 0.035 - 0.120 | Twice Weekly |
| | or Aluminux[4] | 300 | 0.26 - 0.55 (NaOH content) | Twice Weekly |
| Spire Etch | $HNO_3$ | 150 | 0.4 - 1.4 | Weekly |
| Special Products | Aluminux[4] | 100 | 0.26 - 0.55 (NaOH content) | As Necessary |

## 313 Building - Component Preparation (continued)

| Location | Chemical | Quantity (gal) | Concentration (lbs/gal) | Dumping Freq. |
|---|---|---|---|---|
| Special Products | $NaNO_3$ | 300 | 0.33 | Every Other |
| Special Products | Deoxidizer[-2] | 300 | 0.80 - 1.88 | As Necessary |
| Tool Cleaning | NaOH | 200 | 2.5 | Weekly |
| **313 Building - Recovery** | | | | |
| Stripper Tank | NaOH<br>$NaNO_3$ | 300<br>100 pounds per 225 pieces | 1.80 | 12 Times Mont |
| Filter Press | $NANO_3$<br>Uranium (Negl) | 2241 | Unknown<br>4 lbs/month | Continuous When Running |
| **313 Building - Anodizing** | | | | |
| Plating Tanks | $H_2C_2O_4 \cdot 2H_2O$ | 2 - 425 | 0.51 - 0.68 | Infrequently |
| Cleaning Tank | $NaNO_3$<br>NaOH | 125 | 0.5 | 2 Weeks |
| **313 Building - Finishing** | | | | |
| Etch Machine | $HNO_3$ | 1500 | 1.4 - 3.0 | 2-4 Months |
| **313 Building - Slug Pickle** | | | | |
| Pickle Rinse | Uranium | --- | About 60 lbs. per month | Continuous |
| **306 Building** | | | | |
| Hand Cleaning Line | Aluminum[-4]<br>$NaNO_3$ | 100 | 0.26 - 0.55<br>0.20 - 0.40 | 6 Per Month |
| Hand Cleaning Line | Deoxidizer | 60 | 0.80 - 1.20 | 2 Weeks |
| Automatic Cleaning | $HNO_3$<br>NaOH | 80<br>55 | 5.0<br>5.0 - 6.0 | 2 Weeks<br>Every Other |
| Automatic Cleaning | $HNO_3$ | 80 | 2.5 | Twice Monthly |

TABLE II (continued)

Composition consisting mainly of:

- -1 Cleaner: $Na_2CO_3$, $Na_2SiO_3$, $Na_4P_2O_7$
- -2 Deoxidizer: $NaHSO_4$, $CrO_3$ or $Na_2CrO_7$, $Na_2SiF_6$
- -3 Chelating Agent: $NaC_6H_{11}O_7$ (Sodium Gluconate)
- -4 Aluminux: $NaOH$, $NaC_6H_{11}O_7$

3. Contaminated Effluents

Contaminated wastes from Battelle facilities are routinely discharged to storage tanks at the 340 retention and neutralization building as shown in Figure 3, and are later transported to the 200 Areas for disposal. Waste destined for the process pond is held in storage basins, sampled, and then released. Except for an occasional spillage, Battelle does not contribute a significant quantity of radioactivity to the process ponds.

Normal and enriched uranium are discharged from waste solutions from DUN 300-Area operations. In FY 1967, approximately 245 pounds of enriched and 525 pounds of normal uranium were discharged, according to accountability figures, from the Production Fuels Section while the N-Fuels contribution totaled approximately 1,000 pounds.

The anodizing process contributes certain radioactive activation products from the caustic cleaning solution in 306 Building. Gamma scans have shown the presence of $Zn^{65}$ Zr-Nb, $Se^{46}$, $Fe^{59}$, $Co^{60}$, and $Co^{58}$.

4. Sanitary Wastes

One common sanitary waste disposal system serves all 300 Area contractors and is the operational responsibility of DUN.

Sewage flows through vitreous tile pipe to septic tanks, and the daily overflow of approximately 300,000 gallons per day drains into one of two 500-foot long leaching trenches. The septic tanks are periodically cleaned and the solids disposed into a sludge pit located near the leaching trenches. A schematic diagram of this disposal facility is shown in Figure 4.

DUN 300 AREA
PROCESS SEWER LINES (Not to Scale)

FIGURE 2

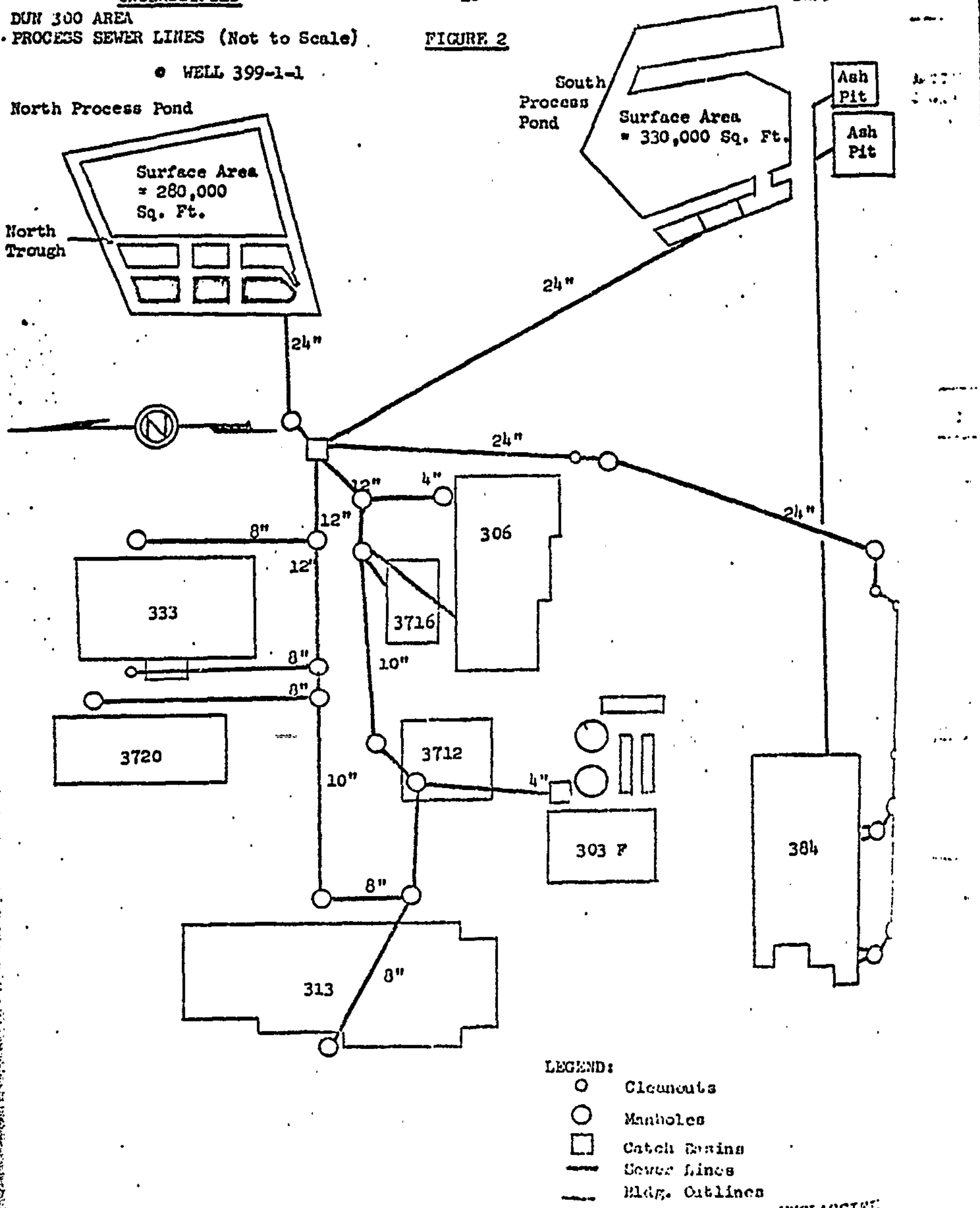


FIGURE 3

300 AREA
SEWER LINES
to Scale)

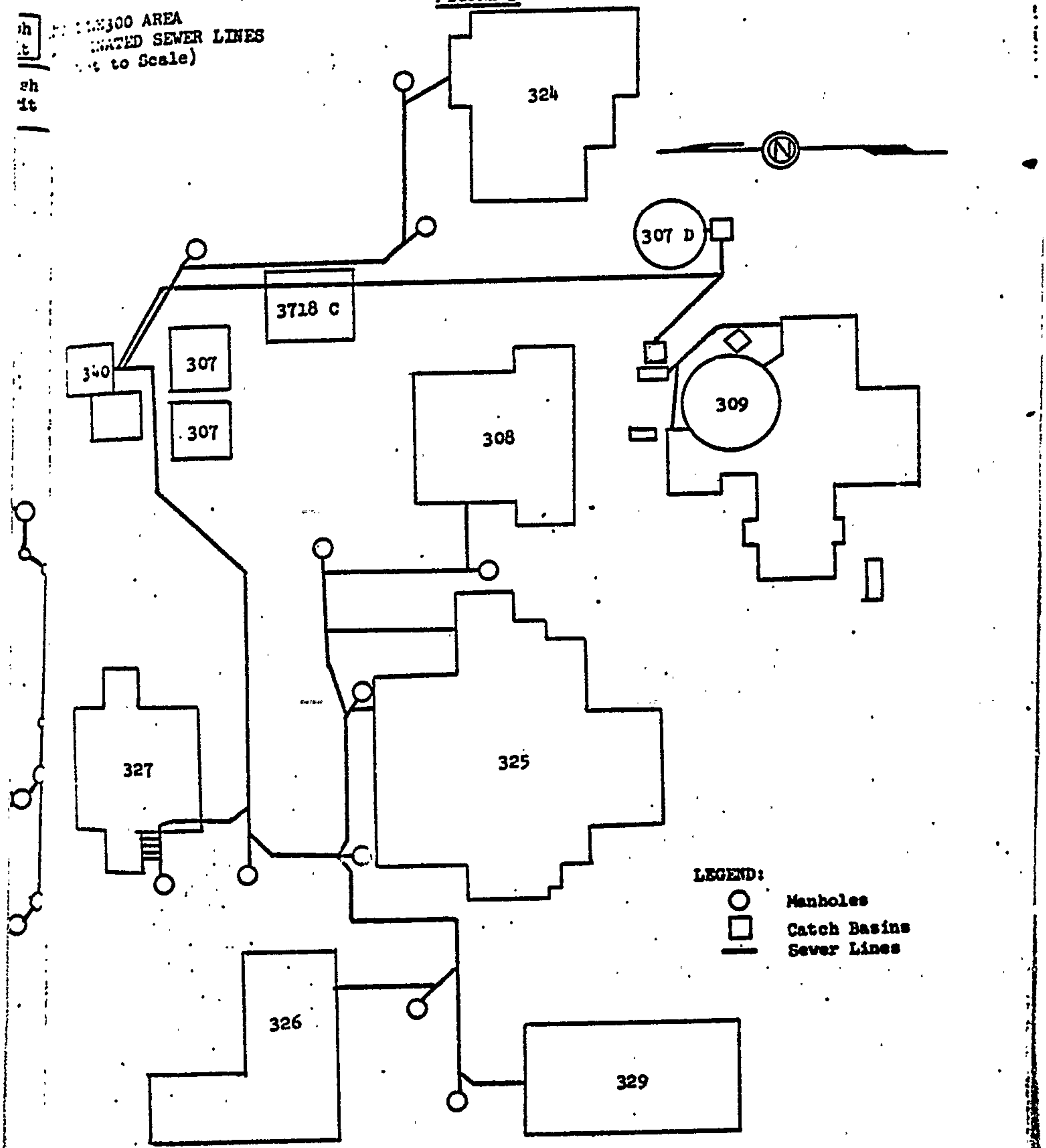
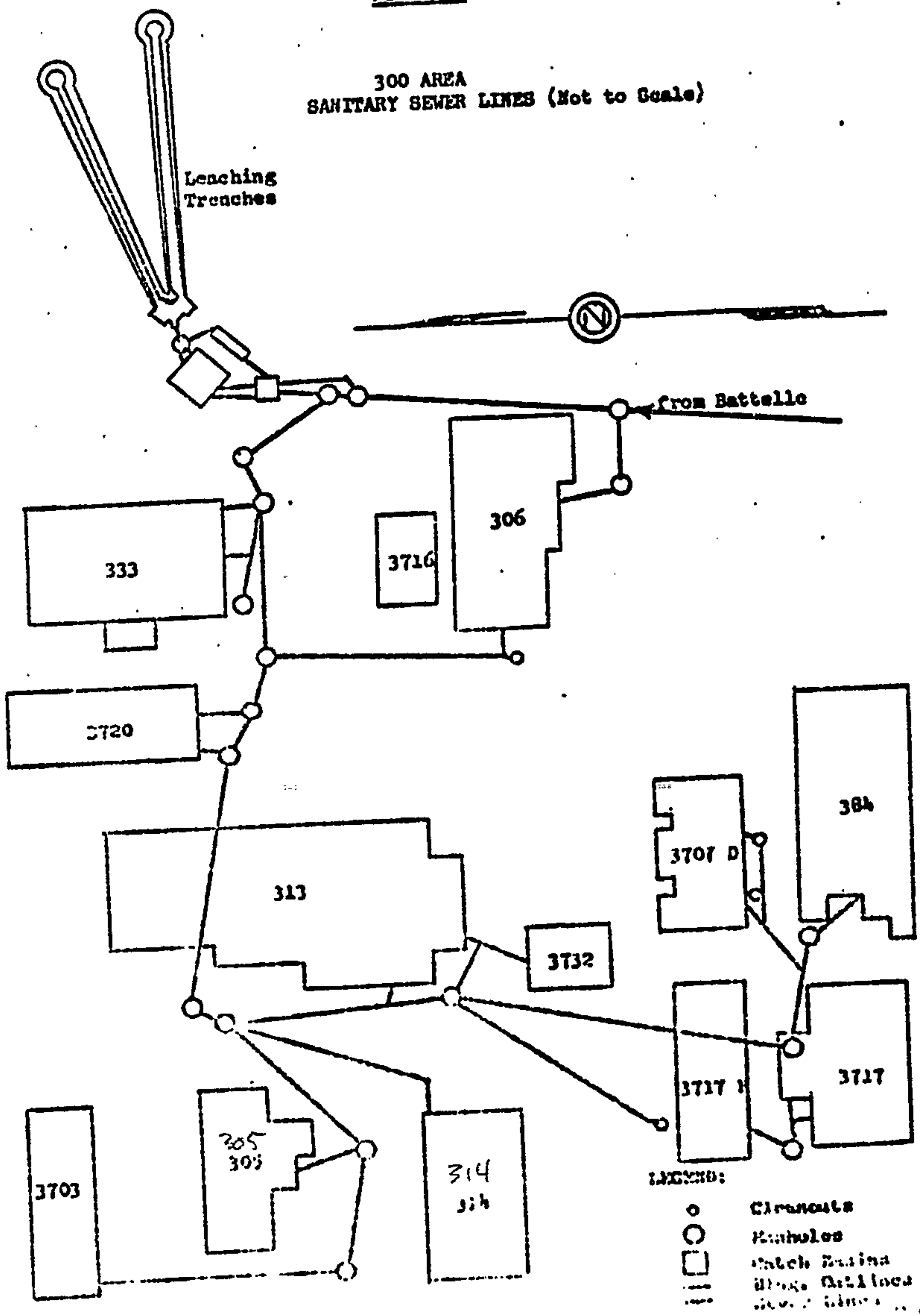


FIGURE 4


300 AREA
SANITARY SEWER LINES (Not to Scale)
Leaching Trenches
from Battelle
306
333
3716
3720
384
3707 D
313
3732
3717 B
3717
3703
305
305
314
314
LEGEND:
Cleanouts
Manholes

B. GASEOUS EFFLUENTS

Gaseous effluents that are routinely discharged to the atmosphere from the Production Fuels Section facilities are listed in Table III.

TABLE III

| Building | Process | Gaseous Effluent | Type Filter Control |
|---|---|---|---|
| 313 | Slug Pickle | $NO_2$, $HNO_3$ | Scrubber |
| 313 | Fuel Element Etch Machines | $NO_2$, $HNO_3$ | Scrubber |
| 313 | Sleeve Machines | NaOH, $NaAlO_2$ | None |
| 313 | Slug Recovery | NaOH Spray | Scrubber |
| 313 | Acid Neutralization | $NO_2$, $HNO_3$ | Scrubber |
| 313 | Spire Etch | NaOH, $NaAlO_2$ | None |
| 313 | Special Products | NaOH Spray, Methanol Trichlorethylene | None |
| 313 | Cap and Can Machines | NaOH Spray, Methanol | None |
| 313 | Rail Degreaser | Trichlorethylene | None |
| 313 | Anodizing | NaOH Spray<br>Oxalic Acid Spray | Scrubber |
| 306 | - - - | $NO_2$, $HNO_3$ | Scrubber |
| 384 | - - - | Combustion Products | Regenerative Fly Ash Collector |
| 3716 | - - - | NaOH<br>$HNO_3$<br>$H_3PO_4$<br>HCl<br>$NiSO_4$<br>$NiCl_2$ | Scrubber |
| 3720 | - - - | HF<br>NaOH<br>$NH_3OH$<br>$HNO_3$<br>HCl<br>$H_2SO_4$<br>Uranium<br>Thoria<br>Be | Particulate Filters |
| 3732 | - - - | $ThO_2$ | Particulate Filter |

## V. CONFORMANCE WITH EFFLUENT CONTROL STANDARDS

### A. LIQUID EFFLUENTS

1. Current practices that satisfy the intent of Executive Order 11288 include:

   - SECONDARY TREATMENT

     The existing process ponds, septic tanks, and leaching trenches provide the necessary secondary treatment.

   - STORAGE FACILITIES

     Storage facilities for liquid chemicals as presently located (See Figure 1) would not contribute a significant amount of water pollution in the Columbia River should rupture or accidental drainage occur. Most of the chemicals would be discharged to the ground. The small amount that could be expected to reach the process sewer would not be significantly greater than is currently being routinely dumped to the ponds from the various process operations in the 313 and 306 Buildings.

     REVIEW AND SURVEILLANCE PROGRAMS

     Weekly effluent samples at the north process pond inlet and east bank have been collected since November, 1966, by Battelle Northwest and analyzed by the DUN Analytical Laboratory. The typical range of contaminants is shown in Table IV. Notice that of those contaminants analyzed in the east bank samples only $Cr^{+6}$, $NO_3$, and F concentrations exceed the drinking water standards of 0.05, 45, and 0.8 ppm, respectively, as shown in Appendix III.

In order to provide additional information concerning the mobility of liquid effluents, a daily grab sample was collected during April, 1967, at three different locations of the north process pond - the inlet, north trough, and east bank. During periods of low river flow, river bank seepage samples were also collected and analyzed to determine the seepage concentrations of $Cr^{+6}$ and $NO_3$. Uranium and some fluoride analyses on certain samples were also included in order to compare the results with uranium accountability losses and determine if the $HNO_3$-HF etch used by N-Fuels on zircaloy was contributing any fluoride to the river. The results of the sampling program are listed in Tables V and VI and are plotted against time in Figures 5 through 10.

TABLE IV

Range of Typical Contaminants

Process Pond Inlet and East Bank

| Contaminant | Inlet (ppm) | East (ppm) |
| --- | --- | --- |
| Copper | ND - 0.11 | 0.002 - 0.11 |
| Iron | ND - 5.9 | ND - 0.12 |
| Sulfate | 8 - 1890 | 14 - 60 |
| Nitrate | 74 - 2484 | 88 - 286 |
| Chloride | 0.6 - 24.0 | 0.5 - 9.2 |
| Chromium (VI) | 0.001 - 200 | 0.01 - 7.0 |
| Zinc | <0.001 - <0.001 | <0.001 - <0.001 |
| Uranium | 0.01 - 3.3 | 0.03 - 1.6 |
| Fluoride | - | 3.5 - 26 |

ND = Not Detectable

A. LIQUID EFFLUENTS (continued)

In reviewing the results of the sampling program, it is important to realize that considerable fluctuation is expected because of the various disposal frequencies of the 300-Area contractors. There is special significance in two of the graphs. Figure 10 illustrates that most of the uranium, as expected, settles out in the vicinity of the inlet, seeps through the soil and enters the river in concentrations significantly higher than those found on the east bank. Since the average inlet uranium concentration of 0.45 ppm is only slightly higher than the average bank seepage concentration of 0.36 ppm, it is believed that very little of discharged uranium is being retained by the soil. These concentrations indicate that approximately seventeen pounds of uranium per day are being discharged to the river from the 300-Area operations. This

## TABLE V

### North Process Pond Analyses (ppm)

| Date | Inlet U | Inlet $NO_3$ | Inlet $Cr^{+6}$ | Trough U | Trough $NO_3$ | Trough $Cr^{+6}$ | East U | East $NO_3$ | East $Cr^{+6}$ | East F |
|---|---|---|---|---|---|---|---|---|---|---|
| MARCH | | | | | | | | | | |
| 27 | .11 | 345 | .17 | .09 | 52 | .03 | .07 | 120 | .15 | |
| 28 | .68 | 83 | .22 | .13 | 96 | .07 | .11 | 148 | .13 | |
| 29 | .27 | 87 | .25 | .16 | 194 | .08 | .13 | 165 | .11 | |
| 30 | .52 | 119 | .68 | .16 | 186 | 3.20 | .04 | 161 | 3.00 | |
| 31 | .17 | 167 | .26 | .11 | 179 | .61 | .05 | 140 | 1.20 | |
| APRIL | | | | | | | | | | |
| 3 | .60 | 201 | .28 | .11 | 125 | .04 | .16 | 370 | .18 | |
| 4 | .11 | 116 | .25 | .13 | 189 | .08 | .18 | 212 | .09 | |
| 5 | .34 | 92 | .25 | .11 | 138 | .13 | .27 | 154 | .16 | |
| 6 | .16 | 109 | .30 | .21 | 157 | .06 | .19 | 193 | .17 | |
| 7 | .19 | 157 | 1.00 | .16 | 315 | .15 | .13 | 222 | .20 | |
| 10 | .11 | 148 | .21 | .07 | 116 | .03 | .14 | 154 | .11 | |
| 11 | .44 | 89 | .22 | .29 | 149 | .07 | .05 | 102 | .08 | |
| 12 | .18 | 93 | .22 | .03 | 316 | .08 | .07 | 140 | .09 | |
| 13 | .55 | 100 | .38 | .22 | 165 | .05 | .05 | 141 | .07 | |
| 14 | .97 | 169 | 45.60 | .22 | 278 | .03 | .03 | 195 | .03 | |
| 17 | .31 | 104 | .30 | .08 | 125 | .31 | .11 | 91 | .60 | |
| 18 | 1.00 | 160 | .22 | .52 | 179 | .11 | .01 | 88 | .60 | |
| 19 | | | | | | | | | | |
| 20 | 1.00 | 145 | .20 | .16 | 248 | .40 | .22 | 145 | .43 | |
| 21 | .18 | 181 | .22 | .06 | 298 | .22 | .04 | 166 | .68 | |
| 24 | .88 | 74 | .20 | .09 | 86 | .06 | .60 | 138 | .21 | |
| 25 | .58 | 221 | .22 | .01 | 153 | .23 | .08 | 114 | .21 | |
| 26 | 1.80 | 6228 | .02 | .02 | 149 | .20 | .08 | 185 | .25 | |
| 27 | .40 | 293 | .20 | .07 | 382 | .08 | .09 | 333 | .12 | |
| 28 | .20 | 257 | .18 | .04 | 245 | .11 | .20 | 269 | .11 | |
| MAY | | | | | | | | | | |
| 1 | | | | | | | | | .80 | 5.0 |
| 2 | | | | | | | | | .34 | 3.5 |
| 3 | | | | | | | | | .11 | 4.7 |
| 4 | | | | | | | | | .16 | 26.0 |
| 5 | | | | | | | | | .17 | - |

TABLE VI

Bank Seepage Analyses (ppm)

| Date | U | $NO_3$ | $Cr^{+6}$ | F |
|---|---|---|---|---|
| MARCH | | | | |
| 30 | .39 | 115 | .17 | - |
| APRIL | | | | |
| 5 | .40 | 136 | .33 | - |
| 11 | .42 | 125 | .25 | - |
| 13 | .38 | 161 | .22 | - |
| 14 | .37 | 99 | .19 | - |
| 17 | .04 | 100 | .16 | - |
| 20 | .42 | 181 | .11 | - |
| 21 | .50 | 122 | .21 | - |
| 27 | .30 | 132 | .40 | - |
| 28 | .40 | 123 | .33 | - |
| MAY | | | | |
| 1 | .30 | | .30 | 4.7 |
| 2 | | | .29 | 4.7 |
| 3 | | | .14 | 4.0 |
| 4 | | | .38 | 4.8 |
| 5 | | | .70 | 3.6 |
| 7 | | | .62 | 10.0 |
| 8 | | | .64 | 4.5 |
| 9 | | | .60 | 4.7 |
| AVERAGE | .36 | 129 | .34 | 5.1 |

FIGURE 5

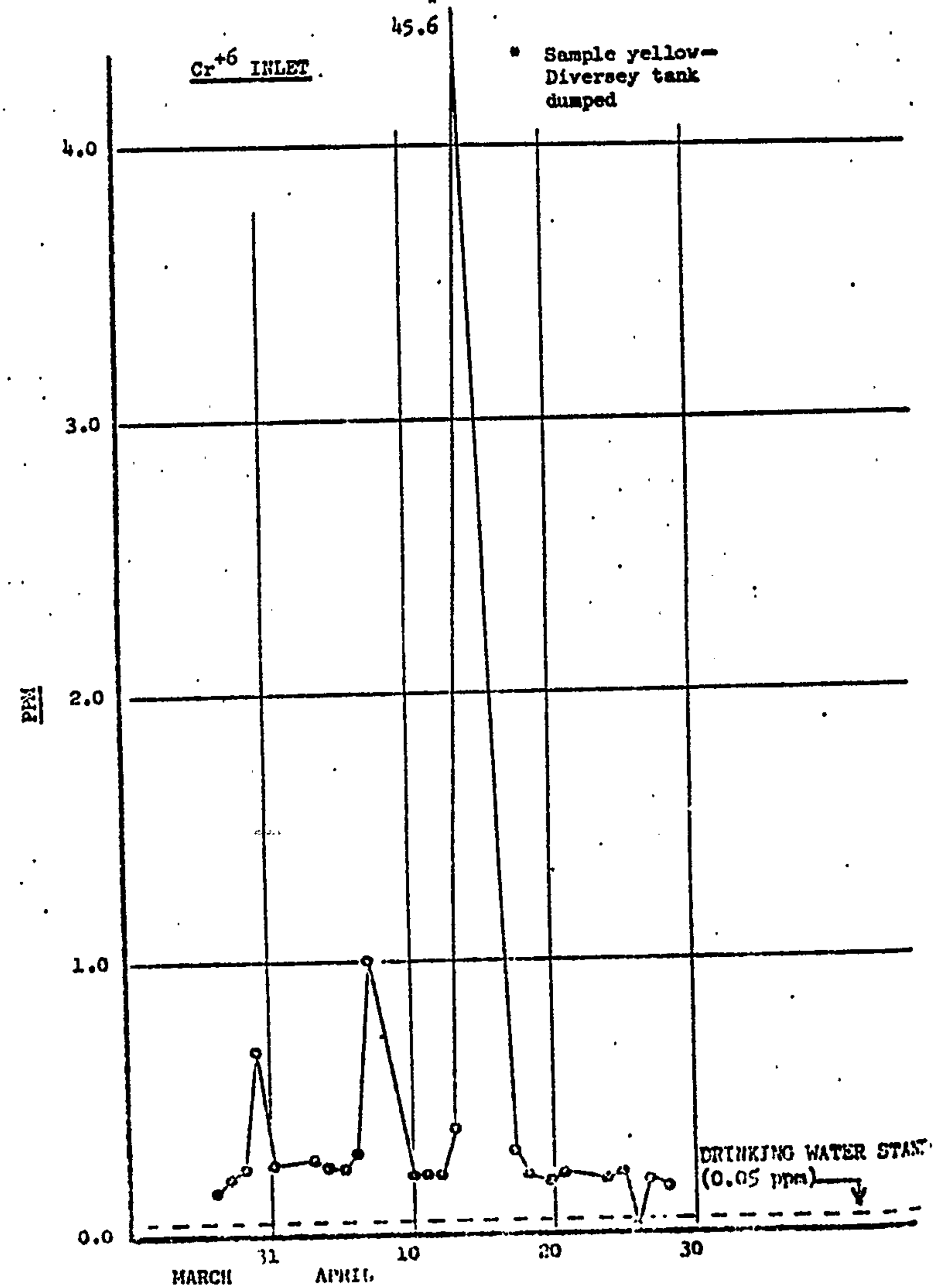

Cr+6 INLET
*
45.6
* Sample yellow—
Diversey tank
dumped
PPM
4.0
3.0
2.0
1.0
0.0
31
10
20
30
MARCH
APRIL
DRINKING WATER STAN
(0.05 ppm)

FIGURE 6

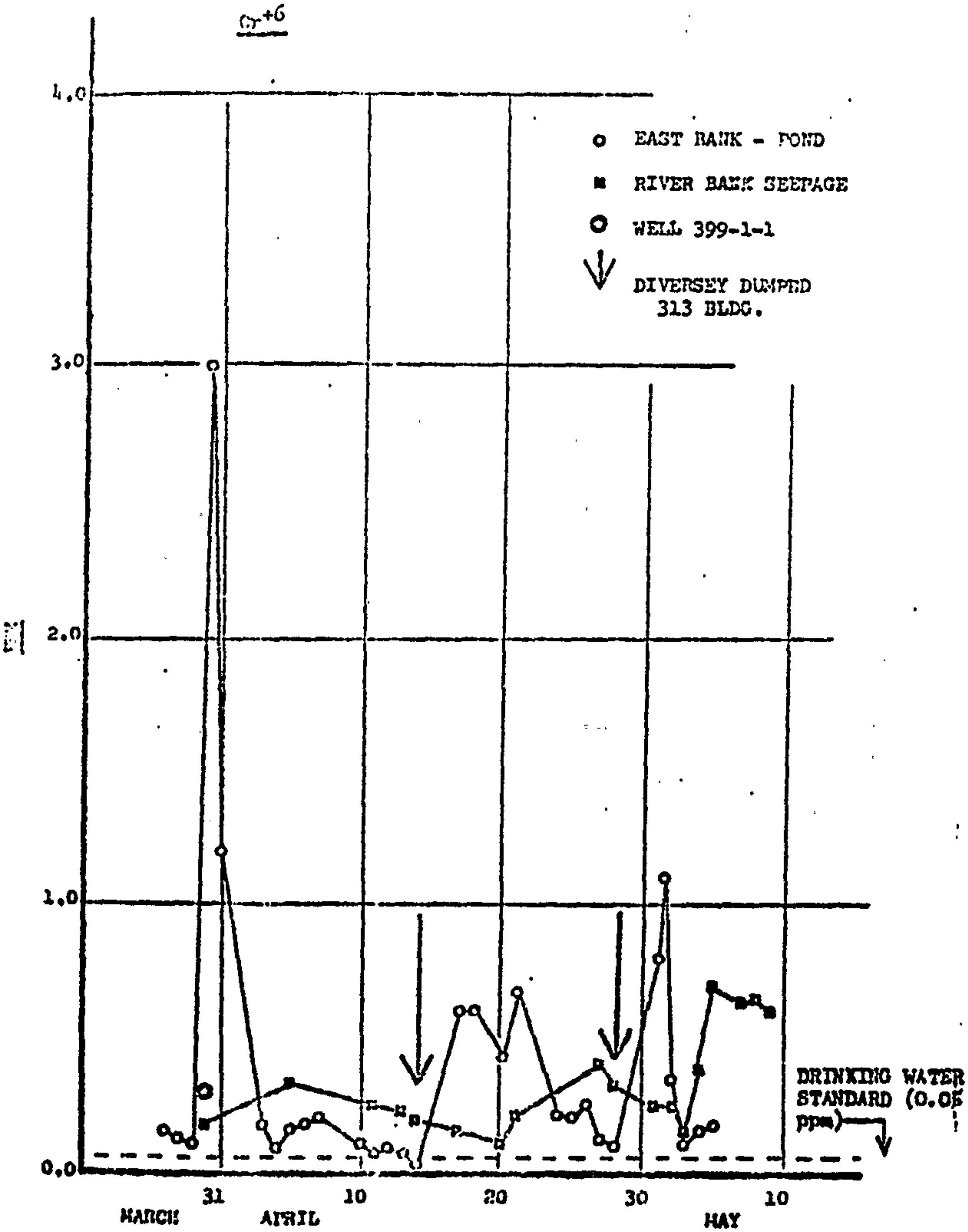
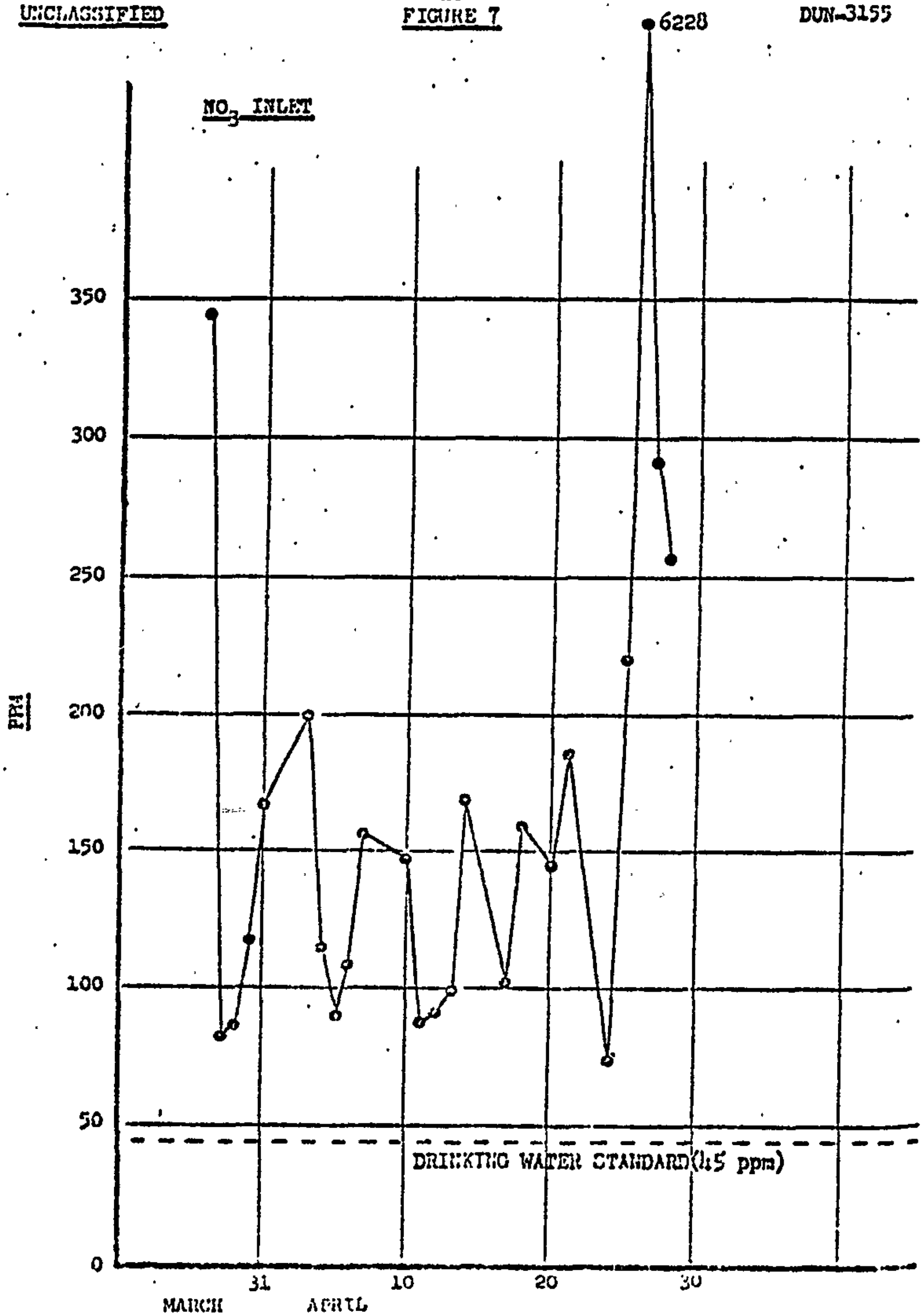

Cr+6
4.0
3.0
2.0
1.0
0.0
PPM
EAST BANK - POND
RIVER BANK SEEPAGE
WELL 399-1-1
DIVERSEY DUMPED
313 BLDG.
DRINKING WATER STANDARD (0.05 ppm)
31
10
20
30
10
MARCH
APRIL
MAY

FIGURE 7



6228
$NO_3$ INLET
PPM
350
300
250
200
150
100
50
0
DRINKING WATER STANDARD (45 ppm)
31
10
20
30
MARCH
APRIL

FIGURE 8

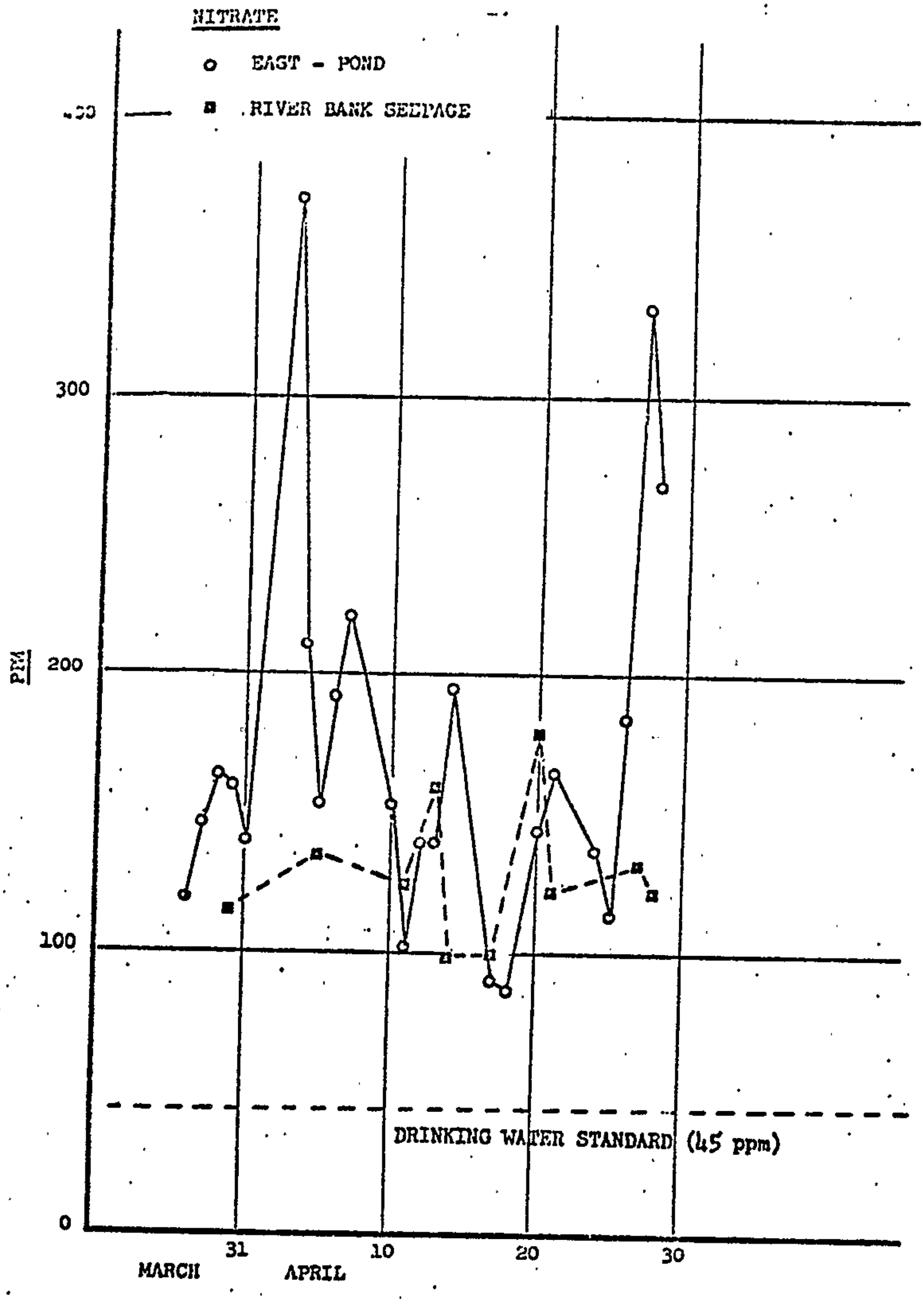

NITRATE
EAST - POND
RIVER BANK SEEPAGE
400
300
200
100
0
PPM
DRINKING WATER STANDARD (45 ppm)
31
10
20
30
MARCH
APRIL

FIGURE 9

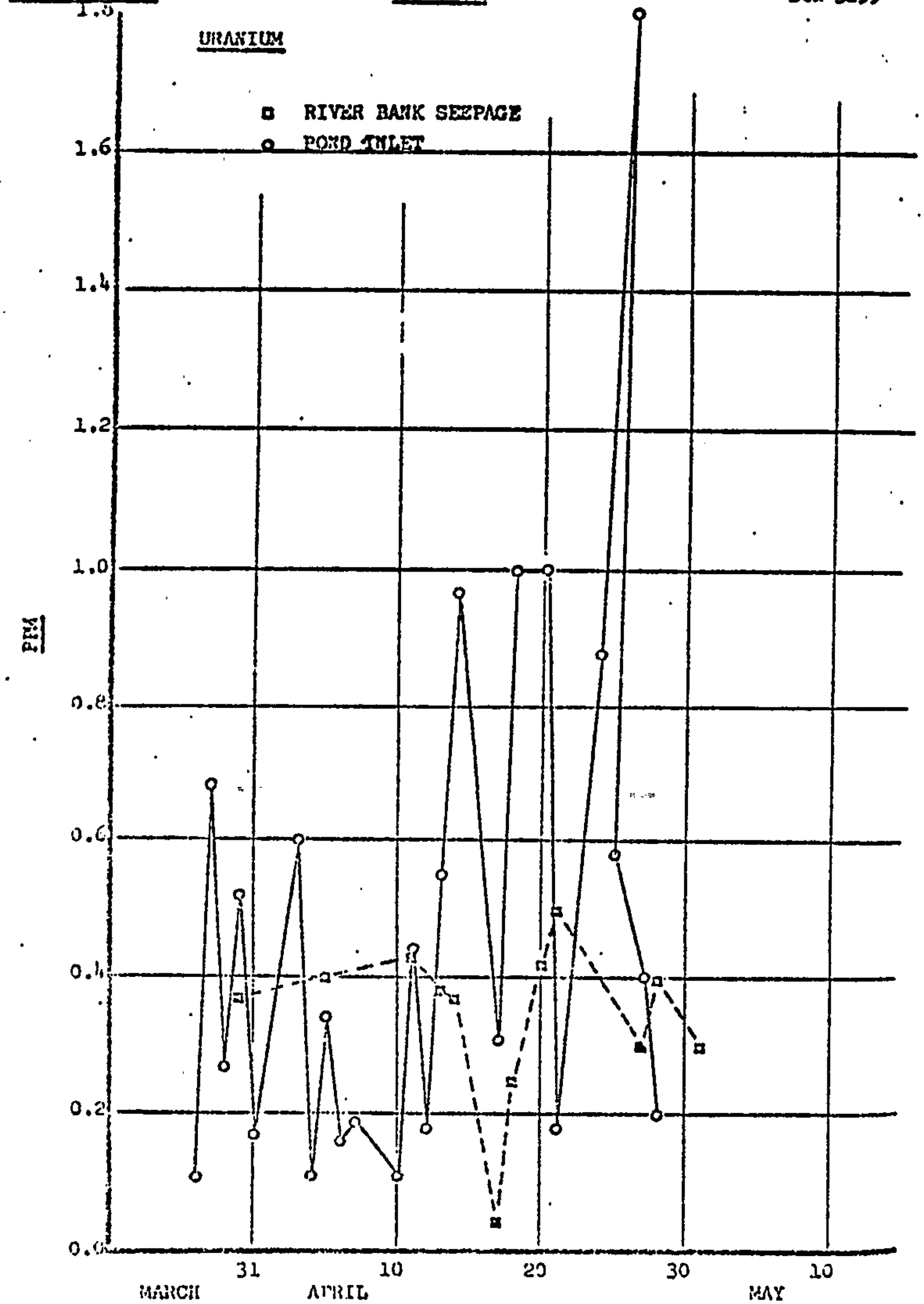
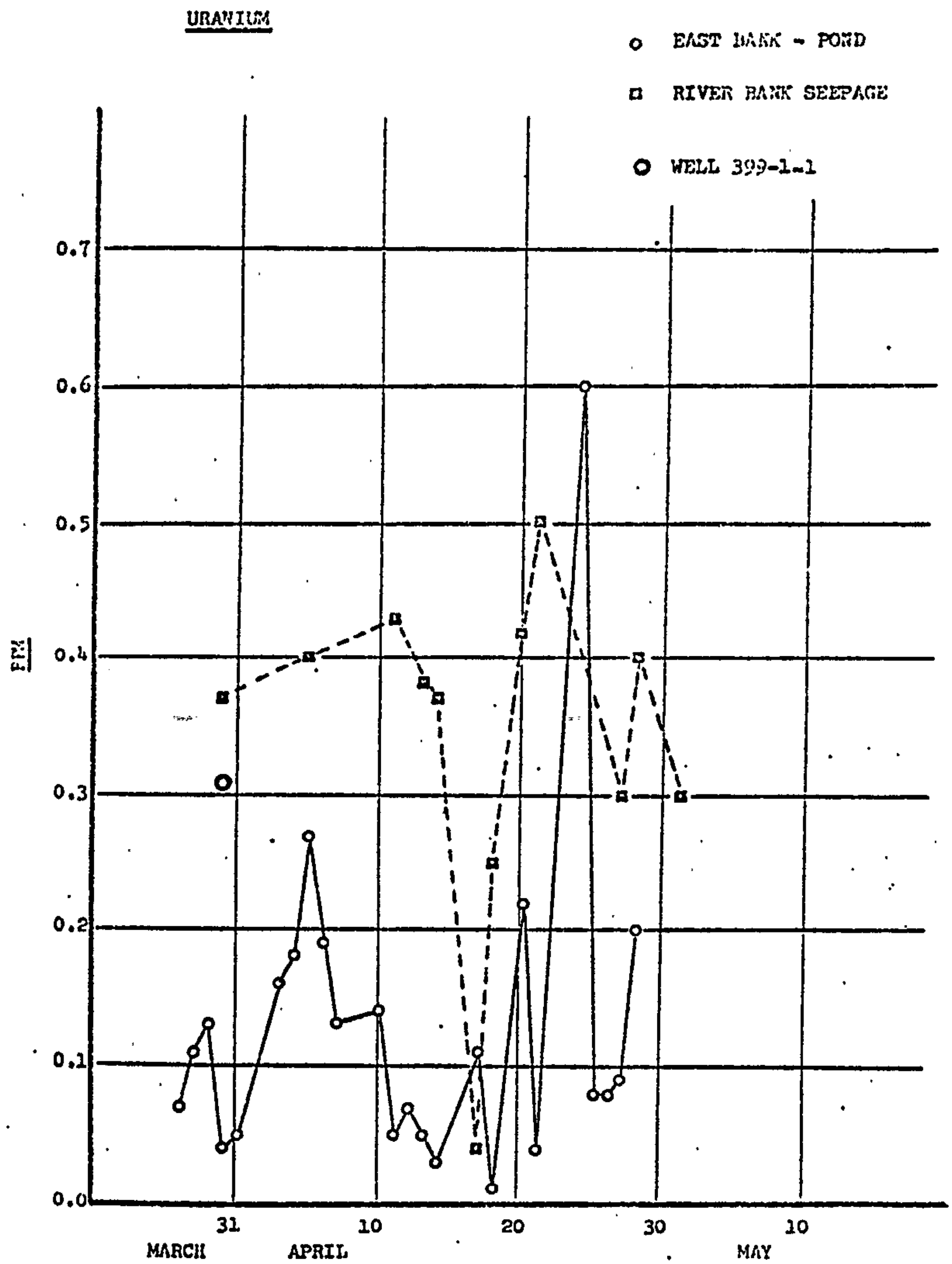

URANIUM
RIVER BANK SEEPAGE
POND INLET
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
PPM
31
10
20
30
10
MARCH
APRIL
MAY

FIGURE 10


URANIUM
EAST BANK - POND
RIVER BANK SEEPAGE
WELL 399-1-1
PPM
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
31
10
20
30
10
MARCH
APRIL
MAY

A. LIQUID EFFLUENTS (continued)

amount of uranium does not contribute measurable human exposure and does not constitute a pollution problem.

The deoxidizer solution from the component cleaning area was identified as the source of the hexavalent chromium noticed in the pond and at the river bank (see Figure 6). After each deoxidizing solution was dumped, a "wave" of $Cr^{+6}$ was generated which reached the river bank some six to seven days later. The concentration rose to a peak of 0.4 ppm and slowly descended approaching the 0.05 ppm limit, but rose again after another deoxidizer tank was dumped. The April 28th, 1967, drain has special significance in this interpretation in that the valve on the process tank was inadvertently left open and a double batch was dumped. Notice that the concentration on the river bank increased significantly (0.7 ppm) after this incident. Although not a significant pollution problem, ways of reducing the source of $Cr^{+6}$ are being investigated. Included are reduction to $Cr^{+3}$ and pumping to 303-F for controlled discharges each day to the sewer. While these concentrations are above the drinking water standard, samples taken by Battelle-Northwest at the Richland Water Plant show an average concentration of 0.008 ppm which is well below the 0.05 ppm limit for drinking water.

Fluctuation of the nitrate content makes any interpretation of the nitrate analyses difficult in regard to seepage rates and major source identification; but, on the average, the bank seepage concentrations (135 ppm) exceed the drinking water standard. Samples taken by Battelle-Northwest indicate a nitrate content less than 1 ppm in Columbia River water at the Richland Water Plant which also is much below the 45 ppm limit for drinking water.

The fluoride analyses indicate that this area should be studied further since two high readings were seen - a 26 ppm concentration in the east bank sample on May 4, 1967, and a resulting 10 ppm concentration in the bank seepage sample of May 7, 1967. Unfortunately, earlier samples were discarded before it was realized that fluoride analyses might be desirable.

Samples from the anodizing spacer cleaning tank were analyzed monthly for radiochemical elements. A typical analysis is shown in Table VII. Previous samples have indicated a maximum alpha activity of $1.0 \times 10^{-5}$ microcuries per milliliter and a maximum beta activity of $1.9 \times 10^{-4}$ microcuries per milliliter.

A. LIQUID EFFLUENTS (continued)

While the maximum beta activity exceeds the limit of $5 \times 10^{-5}$ microcuries per milliliter permitted by RL Manual Appendix 0510, sufficient dilution is realized before the contaminants enter the process pond. Radiochemical analysis of samples taken from the north process pond, well 399-1-1, and Columbia River seepage (Table VIII) have shown a maximum total beta activity of $2.8 \times 10^{-7}$ microcuries per milliliter. It is assumed that the alpha activity is also in this range with neither activity level constituting a pollution problem.

TABLE VII

Typical Radiochemical Analysis of Anodizing Caustic Solution

| Isotope | Activity Level (μc/ml) |
|---|---|
| $Zn^{65}$ | 0.19 |
| Zr-Nb | 0.09 |
| $Se^{46}$ | 0.27 |
| $Fe^{59}$ | 0.03 |
| $Co^{60}$ | 0.02 |
| $Co^{58}$ | Trace |
| Maximum Beta | $1.9 \times 10^{-4}$ |
| Maximum Alpha | $1 \times 10^{-5}$ |

TABLE VIII

Typical Radiochemical Analysis of Well 399-1-1 and Bank Seepage Samples

| Isotope | Bank Activity Level (μc/ml) | Well 399-1-1 Activity Level (μc/ml) |
|---|---|---|
| $Zn^{65}$ | $9.1 \times 10^{-8}$ | $9.1 \times 10^{-8}$ |
| $Co^{60}$ | $8.8 \times 10^{-8}$ | $8.7 \times 10^{-8}$ |
| $Cr^{51}$ | $9.1 \times 10^{-7}$ | $1.4 \times 10^{-6}$ |

TABLE VIII (continued)

| Isotope | Bank Activity Level (μc/ml) | Well 399-1-1 Activity Level (μc/ml) |
|---|---|---|
| $Np^{239}$ | $5.6 \times 10^{-5}$ | $5.7 \times 10^{-5}$ |
| Maximum Beta | $2.8 \times 10^{-7}$ | $2.1 \times 10^{-7}$ |

A study made by A. B. Johnson (1)* indicated that radioactive activation product buildup is not to be anticipated in the process sewer system because of the periodic releases of the caustic cleaning solution. Samples will continue to be taken in order to assure control of these releases. In addition, Battelle-Northwest is periodically sampling the wells in the vicinity of the ponds in order to assess the magnitude of radio-chemical contamination flowing to the river.

Samples have been taken from the leaching trenches and the river, both above and below the trenches, by Battelle-Northwest and analyzed for coliform content and biochemical oxygen demand (BOD). A typical analysis is shown in Table IX. (For a further explanation of coliform and BOD and their relationship to water pollution, see Appendix III.) Based on these analyses, the 300-Area sanitary waste treatment system is judged to be performing an adequate secondary treatment of sanitary wastes.

TABLE IX

Bacteriological Analysis of Leaching Trenches, Wells, and Columbia River

| Date | Location | Coliform/100 ml | BOD, mg/l |
|---|---|---|---|
| 2/16/67 | Leach Trench | 80,750 | 28 |
| | Well 399-1-3 | 20 | 0 |
| | Well 399-3-1 | 120 | 0 |
| 3/14/67 | Leach Trench | 82,000 | 4.9 |
| | Well 399-1-3 | 75 | 0 |
| | Well 399-3-1 | 9 | 0 |
| 5/19/67 | Leach Trench | | |
| | Head End | 22,500 | 15.8 |
| | River End | 31,000 | 18.6 |
| | River | | |
| | Upstream | 3.5 | 3.7 |
| | Seepage Area | 6 | 3.0 |

* The numbers in parentheses ( ) refer to the list of References.

A. LIQUID EFFLUENTS (continued)

OPERATING PROCEDURES

Operating procedures involving the receiving, storage, and distribution of liquid chemicals and their subsequent use in the process are outlined in documents HW-38058-100 REV and HW-38058-200 REV, "Manufacturing Operation Operating Procedures, Fuels Preparation Department." These documents provide a comprehensive summary of the procedures and equipment used to control the various production process variables.

Specific sections of these documents are related to the control of liquid effluents and include the following:

a. Receiving, Storage, and Distribution of Liquid Chemicals (HW-38058-100 REV).

| Section | Procedure |
|---|---|
| 150 | Tank Car and Truck Sampling |
| 151 | Receiving, Storage, and Distribution of Nitric Acid |
| 152 | Receiving, Storage, and Distribution of Caustic |
| 153 | Receiving, Storage, and Distribution of Trichlorethylene |
| 154 | Nitrated Caustic Mixing and Distribution |
| 155 | Twenty-five Percent Sleeve Caustic Mixing and Distribution |
| 156 | Diversey 514 Solution |
| 157 | Methanol Tank Car Unloading |
| 158 | Altrex Mix and Distribution |
| 159 | Caustic Meter Operation |

OPERATING PROCEDURES (continued)

b. Use and Discharge of Liquid Wastes

| Section | Procedure |
|---|---|
| | Recovery (HW-38058-100 REV) |
| 130 | Stripping Tank Equipment |
| 131 | Stripping Operation |
| 132 | Treating Tank Equipment |
| 133 | Treating Operation |
| 134 | Operation of Centrifugal Pumps |
| 136 | Spent 50% Caustic Transfer |
| 137 | Neutralizing Process Equipment |
| 138 | Neutralizing Process Operation |
| 139 | Pressure Tank Equipment |
| 140 | Pressure Tank Operation |
| 141 | Filter Press Equipment |
| 142 | Filter Press Operation |
| | Pickle Machine Operation (HW-38058-200 REV) |
| 225 | Pickle Machine Startup |
| 226 | Pickle Machine Operation |
| 228 | Pickle Machine Equipment |
| 229 | Pickle Degreaser Still Startup |
| 230 | Pickle Degreaser Still Operation |
| 231 | Degreaser Still Equipment |

OPERATING PROCEDURES (continued)

Sleeve Machine Operation
([illegible])

| | |
|---|---|
| 240 | Sleeve Cleaning Machine Startup |
| 241 | Sleeve Cleaning Machine Operation |
| 242 | Sleeve Cleaning Machine Equipment |
| 243 | Sleeve Cleaning Machine Solution Makeup |

Cap and Can Machine Operation
(HW-3095[illegible] REV)

| | |
|---|---|
| 250 | Cap and Can Machine Startup |
| 251 | Cap and Can Machine Operation |
| 252 | Cap and Can Machine Equipment |
| 253 | Cap and Can Cleaning Machine Solution Makeup |
| 254 | Cap and Can Machine Safety Protection |
| 256 | Cap and Can Degreaser Still Startup |
| 257 | Cap and Can Degreaser Still Equipment |
| 258 | Methanol Still Startup |
| 259 | Methanol Still Operation |
| 260 | Methanol Still Equipment |

2. Future action to assure continuing compliance with Executive Order 11258 includes:

SAMPLING PROGRAMS

On July 17, 1967, an automatic sampler was located at the 300-Area north process pond to gather a composite sample of aqueous effluents discharged from the 300-Area operations. Chemical and radiochemical analyses will be periodically performed in order to maintain a continuing inventory of

SAMPLING PROGRAMS (continued)

possible pollutants. A description of the sampler and its operating characteristics is shown in Appendix IV.

In addition to the pond samples, periodic grab samples are taken at the wells in the vicinity of the ponds along with bank seepage samples whenever river conditions permit.

Samples will continue to be taken of the anodizing caustic cleaning solution, and the results will be recorded and periodically reported in order to maintain continuing cognizance of this disposal activity.

Battelle-Northwest will continue to sample the leaching trenches and river for BOD and coliform content. These results will be periodically supplied to DUN.

REVIEWS

Periodic reviews of operating procedures and practices involving effluent control will be performed to insure continuing compliance with established release criteria. Quality Control will be responsible for coordinating future replies to effluent control practices.

B. GASEOUS EFFLUENTS

COMBUSTION OF FUELS

In conjunction with the compliance with Executive Order 11282, HEHF was requested to sample the 384 building powerhouse stack in order to measure the emission density of the smoke and the concentration of sulfur dioxide and recommend a detector or alarm system to monitor releases from the combustion units. The results of this sampling program have been reported by HEHF (2). Certain difficulties were encountered in obtaining representative stack gas samples because of the lack of available sample lines and particle size analysis was not made. Air samples were collected from the 150-foot stack and compared with the theoretical emission rate based on power level. At a steam generation level of 25,000 - 27,000 pounds per hour, the theoretical $SO_2$ concentration by use of fuel consumption is 214 ppm. The sample showed a concentration of 143 ppm.

By the use of curves comprised of ambient air concentrations versus meteorological parameters as related to stack gas sources, and assuming a steam load of 50,000 pounds per hour, a stack emission of $1.7 \times 10^{-3}$ cubic meters of $SO_2$ per second

COMBUSTION OF FUELS (continued)

would result. Estimated ground level concentrations extrapolated from meteorological surveys would be less than 0.1 ppm at 4,000 meters under stable atmospheric conditions and 5.0 ppm at 60 to 70 meters under unstable atmospheric conditions. Because the boilers that are normally operated during high steam generation (50,000 to 125,000 pounds of steam per hour) were not operating during the study, it appears that the on-site ground concentrations of $SO_2$ could be of concern. For this reason, supplementary studies will be made during the winter months when high steam generation rates are expected.

Studies have shown that a concentration of 0.6 ppm of $SO_2$ will produce no detectable response in healthy human beings; but in the range between 1 and 5 ppm, most persons will begin to show a detectable response (3). There is no sound evidence that chronic exposure to concentrations below 5 ppm of $SO_2$, by itself, has any persistently ill effects. Most people can detect 5 ppm, and it produces a distinctive gross physiological response - exposure for one hour causes choking. Most people find 10 ppm quite unpleasant; an exposure for one hour to this concentration produces severe distress.

It appears from the mathematical model used by HEHF that concentrations of greater than 5 ppm could be found at ground level during high generation, and it could be that certain controls will have to be implemented should this turn out to be the case.

Smoke density measurements made with a Mines Safety Appliance Smokescope showed that the density of the smoke was below shade number one on the Ringelmann Scale and, therefore, complies with the standard. Since the smoke density complies with the standard, it is believed that the particle size emission is also below the allowable release level. Measurement of particle size would be very difficult, and HEHF feels that it is no problem.

It is interesting to note that when the size of particles in an exhaust stream approaches the wave length of light, the stack discharge is quite visible in spite of the fact that the actual quantity of particles may be small. Thus, since visibility of an effluent exhaust is a function of the light-reflecting surfaces of the escaping material and since surface area per pound increases inversely with the square of the particle size, it is possible to remove 80 to 90 percent of the material from an exhaust stack without altering its appearance (4).

COMBUSTION OF FUELS (continued)

The recommendation from HEHF as to the type of smoke alarms for monitoring the combustion units is pending until a reply to an inquiry to the Department of Health, Education, and Welfare is received.

DISPOSAL OF REFUSE

Current disposal practices do not conform to the daily limit of 25 pounds of material that can be burned in open pits; but because of the remote location, low population density, refuse being primarily paper, and favorable meteorological conditions, it is believed that this standard is unduly restrictive, and an exemption has been requested by the RL-AEC. In conjunction with the dark-smoke-producing requirement, all subsections within the Production Fuels Section have been informed that should significant quantities of this material be generated, special disposal procedures should be used.

OTHER POLLUTION-PRODUCING PROCESSES

HEHF has sampled the stacks in the 313 and 306 buildings and has issued a report on the concentrations of gaseous effluents (5). The results indicate that scrubber replacements should be considered (see Appendix VIII for diagrams of current scrubber systems).

HEHF is scheduled to procure air monitoring equipment in October, 1967, and will monitor selected locations in the 300 Area to determine if the Production Fuels Section's gaseous effluents are harmful. Until that time, no change in the current mode of operation is contemplated.

RADIOACTIVITY

Previous investigation has shown that the Production Fuels Section does not contribute any gaseous radioactive effluents to the atmosphere that would be considered as harmful or hazardous to the public (6).

## VI. RECORDS AND REPORTING

### A. LIQUID EFFLUENT SAMPLES

Chemical and radiochemical analyses of the 300-Area process effluents will be reported monthly in the Quality Control Record Report. Significant changes will be discussed along with the planned action of reduction of the concentrations of those contaminants which are considered potential pollution contributors. The analyses will be supplied to those persons responsible for preparing the DUN Annual Report on Pollution Control Practices.

Summaries of the coliform and BOD content of leaching trenches and Columbia River samples will be reported when received from Battelle.

Semiannual radioactive waste disposal reports will be prepared based on the requirements of RL-0510.

### B. GASEOUS EFFLUENTS

HERF will be periodically sampling at different locations in the 300 Area starting in October, 1967. The results of these sampling programs will be documented and distributed to those concerned with this program. A semiannual gaseous effluent analysis of the Production Fuels Section buildings will be made and documented. Based on the results of these analyses, recommended changes will be offered in order to assure continuing compliance. The results of these various sampling programs, likewise, will be supplied to those responsible for conducting the annual DUN report on gaseous effluent control and the semiannual radioactive disposal report.

## VII. ACKNOWLEDGMENTS

Appreciation is extended to C. D. Corbit for his review and suggestions and to C. T. Houghan for his effort in supplying the graphs and drawings.

## LIST OF REFFRENCES

(1) A. B. Johnson, "Anodizing Process Waste Study," DUN-2431, April 24, 1967

(2) D. E. Anderson, HANFORD ENVIRONMENTAL HEALTH FOUNDATION, "The Release of Atmospheric Pollutants from DUN Facilities - 100 B and C, 100 KE and KW, and 300 Area," June, 1967

(3) AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, "Air Conservation," 1965, Publication No. 80, p. 62

(4) "Machine Design," July 20, 1967, p. 37

(5) W. E. Gill, HANFORD ENVIRONMENTAL HEALTH FOUNDATION, "Gaseous Effluent Survey, 313 Building," June, 1967

(6) C. D. Corbit, "Waste Disposal Inspection Report of Douglas United Nuclear," HAN-94336, April 20, 1966